

Population Dynamics, Carrying Capacity, and Conservation Biology

**G. Tyler Miller's
Living in the Environment
12th Edition**

Chapter 9

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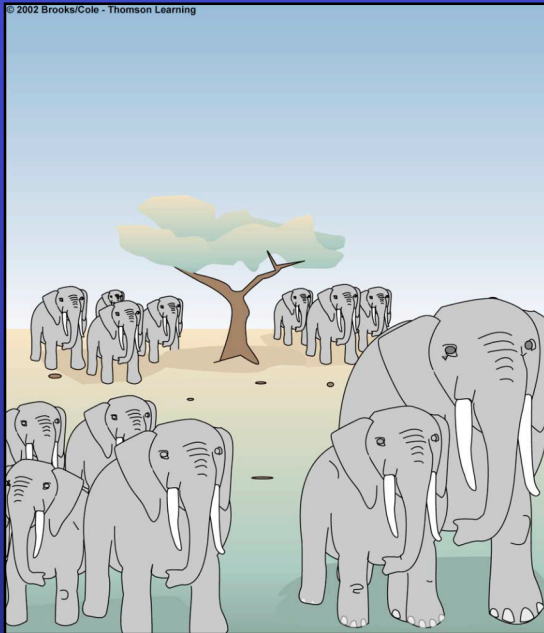
Key Concepts

- **Factors affecting population size**
- **Species reproductive patterns**
- **Species survivorship patterns**
- **Conservation biology and human impacts on ecosystems**

Population Dynamics and Carrying Capacity

- **Population dynamics**
- **Zero population growth (ZPG)**
- **Biotic potential (intrinsic rate of increase $[r]$)**
- **Environmental resistance**
- **Carrying capacity**
- **Minimum viable population (MVP)**

Population Dispersion



**Clumped
(elephants)**



**Uniform
(creosote bush)**



**Random
(dandelions)**

Factors Affecting Population Size

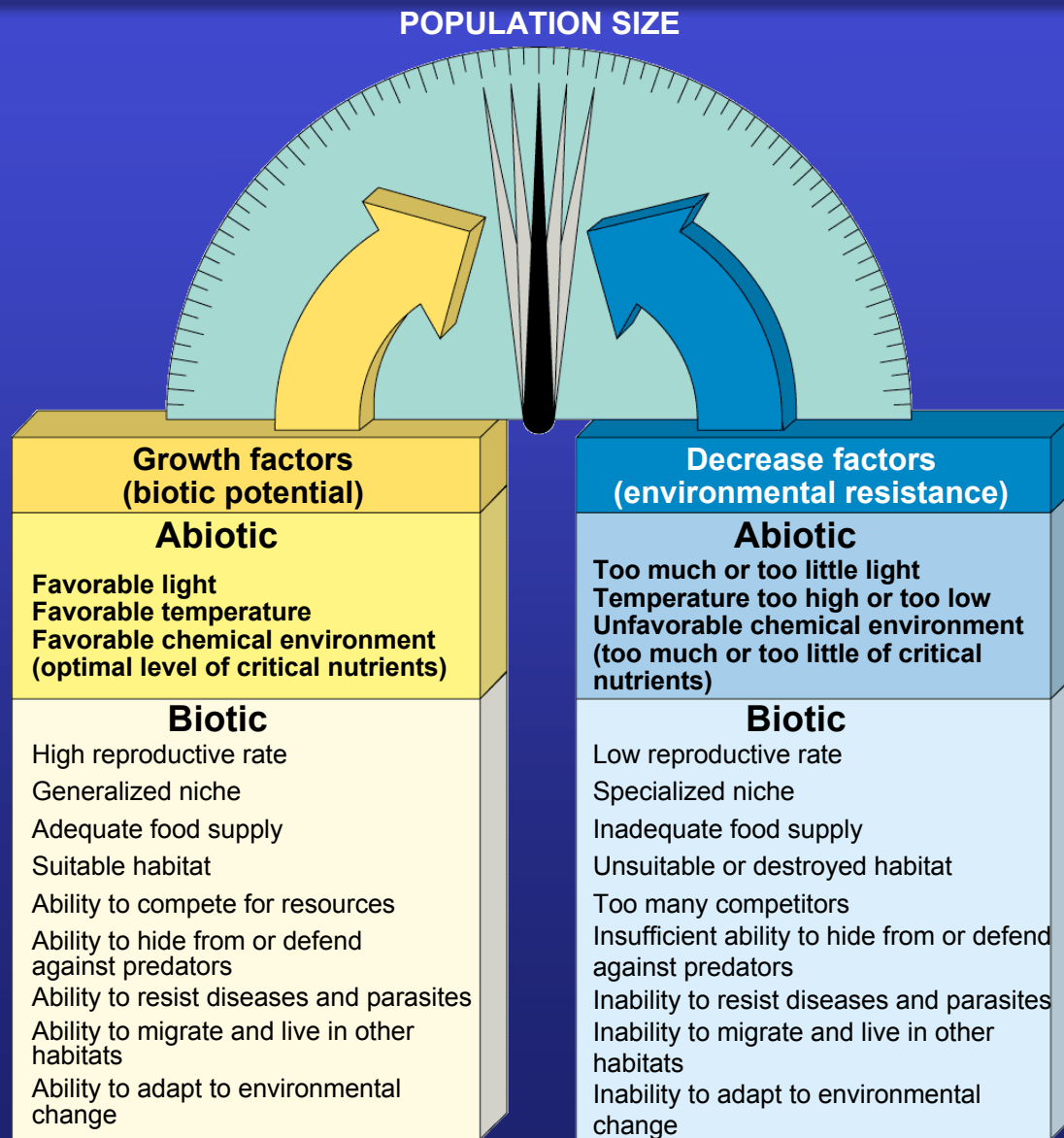
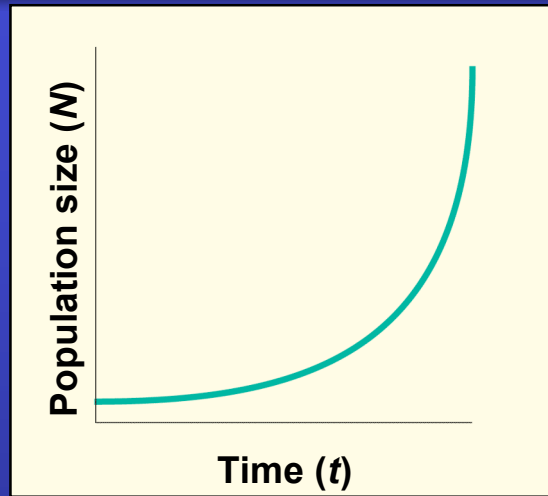


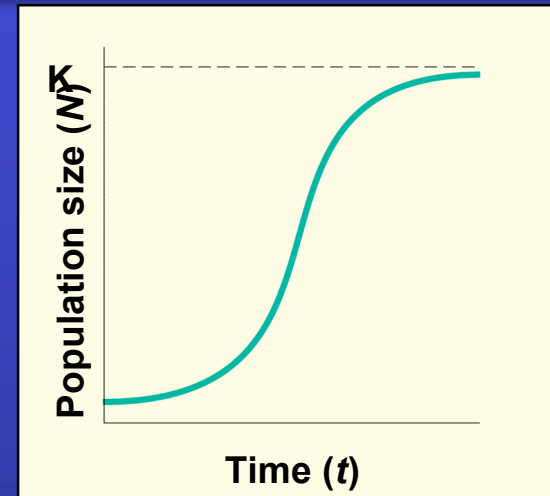
Fig. 9.3, p. 200

Exponential and Logistic Growth

Fig. 9.4, p. 201



Exponential Growth



Logistic Growth

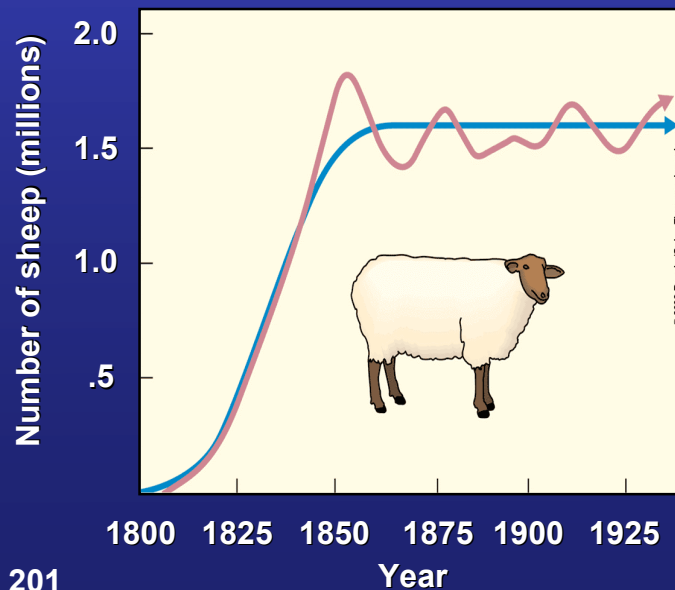


Fig. 9.5, p. 201

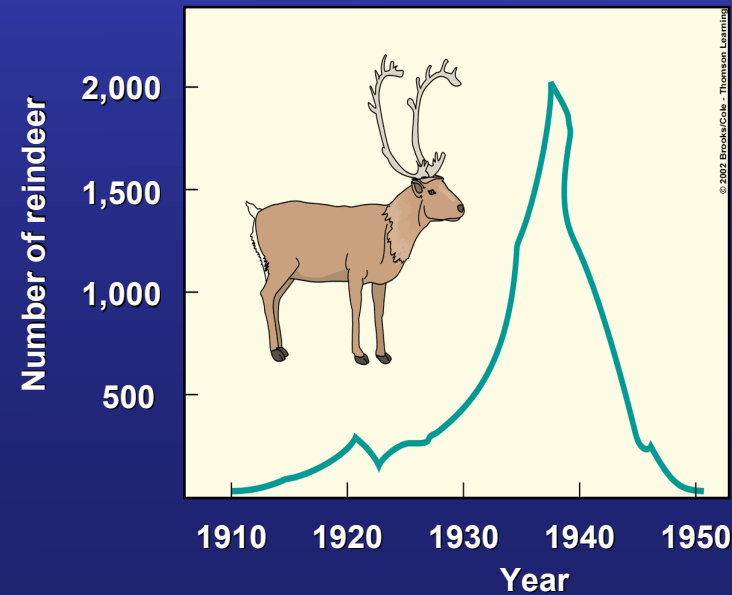


Fig. 9.6, p. 201

Population Density Effects

- **Density-independent controls**
- **Density-dependent controls**

Natural Population Curves

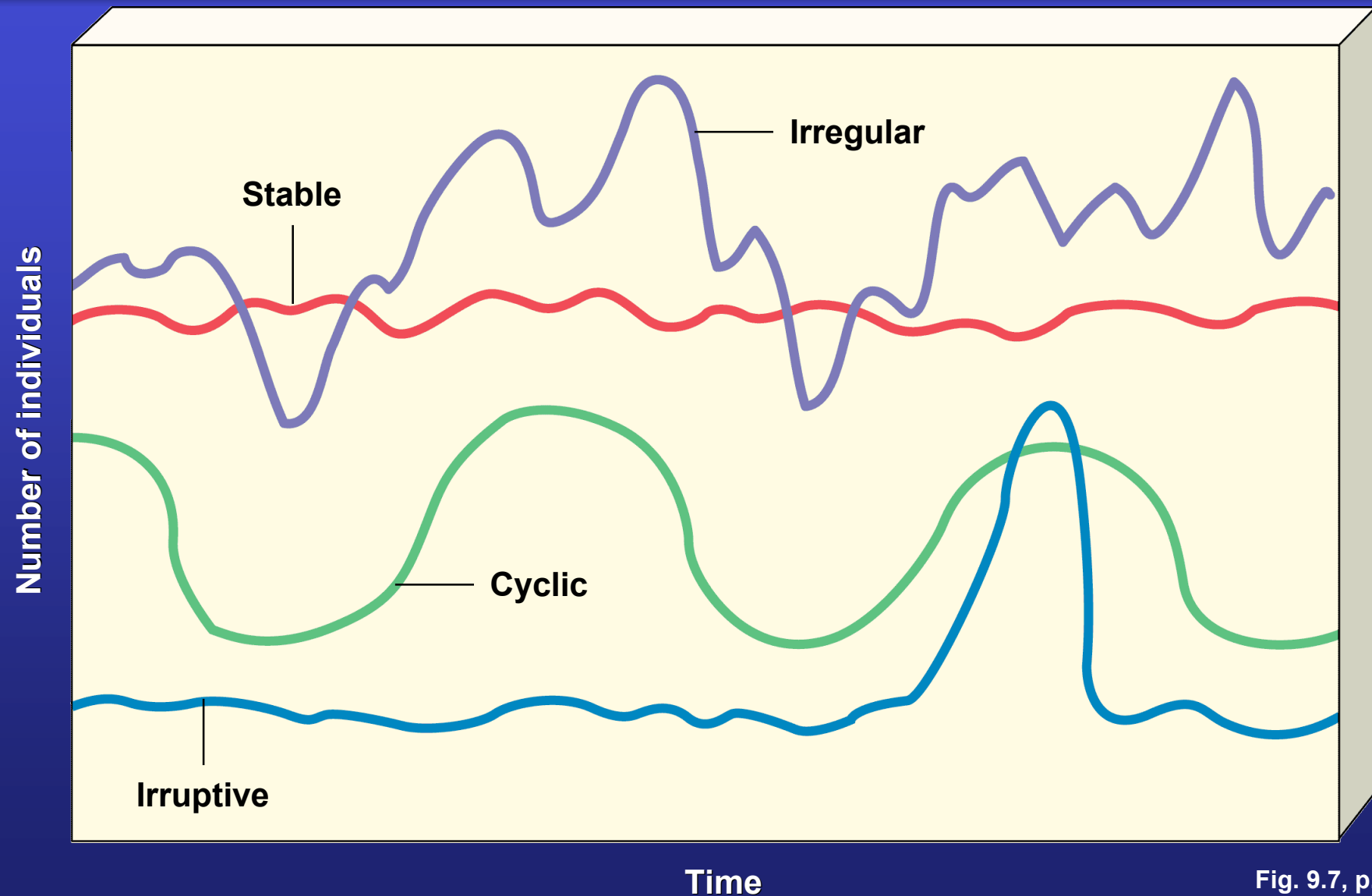
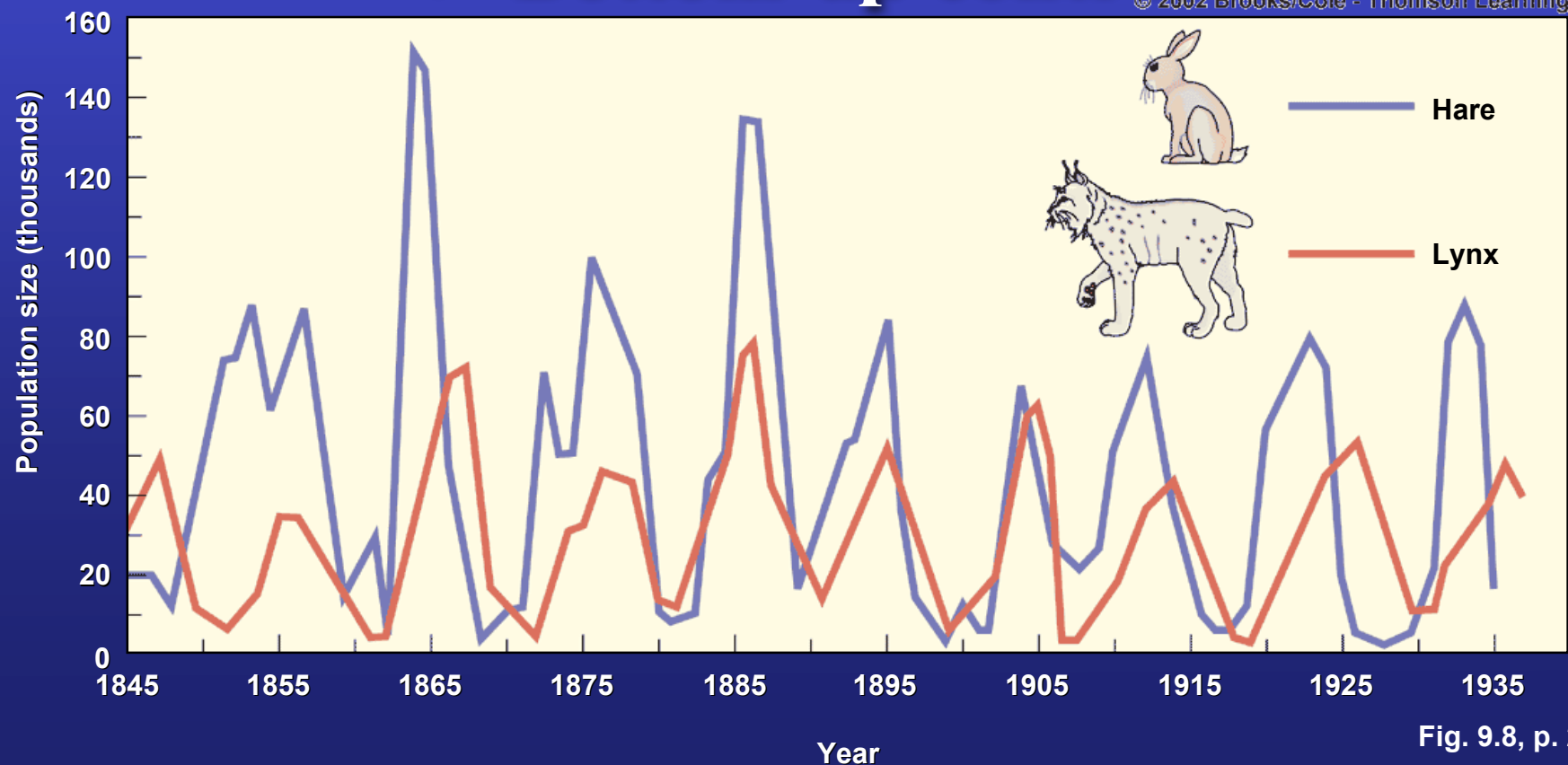


Fig. 9.7, p. 202

The Role of Predation in Controlling Population Size

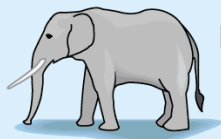
- Predator-prey cycles
- Top-down control
- Bottom-up control



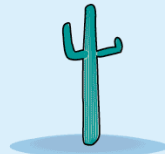
Reproductive Patterns and Survival

- Asexual reproduction
- Sexual reproduction
- r-selected species
- K-selected species

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K-Selected Species



saguaro

elephant

Fewer, larger offspring
High parental care and protection of offspring
Later reproductive age
Most offspring survive to reproductive age
Larger adults
Adapted to stable climate and environmental conditions
Lower population growth rate (r)
Population size fairly stable and usually close to carrying capacity (K)
Specialist niche
High ability to compete
Late successional species

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r-Selected Species



dandelion

cockroach

Many small offspring
Little or no parental care and protection of offspring
Early reproductive age
Most offspring die before reaching reproductive age
Small adults
Adapted to unstable climate and environmental conditions
High population growth rate (r)
Population size fluctuates wildly above and below carrying capacity (K)
Generalist niche
Low ability to compete
Early successional species

**Fig. 9.10b,
p. 205**

Survivorship Curves

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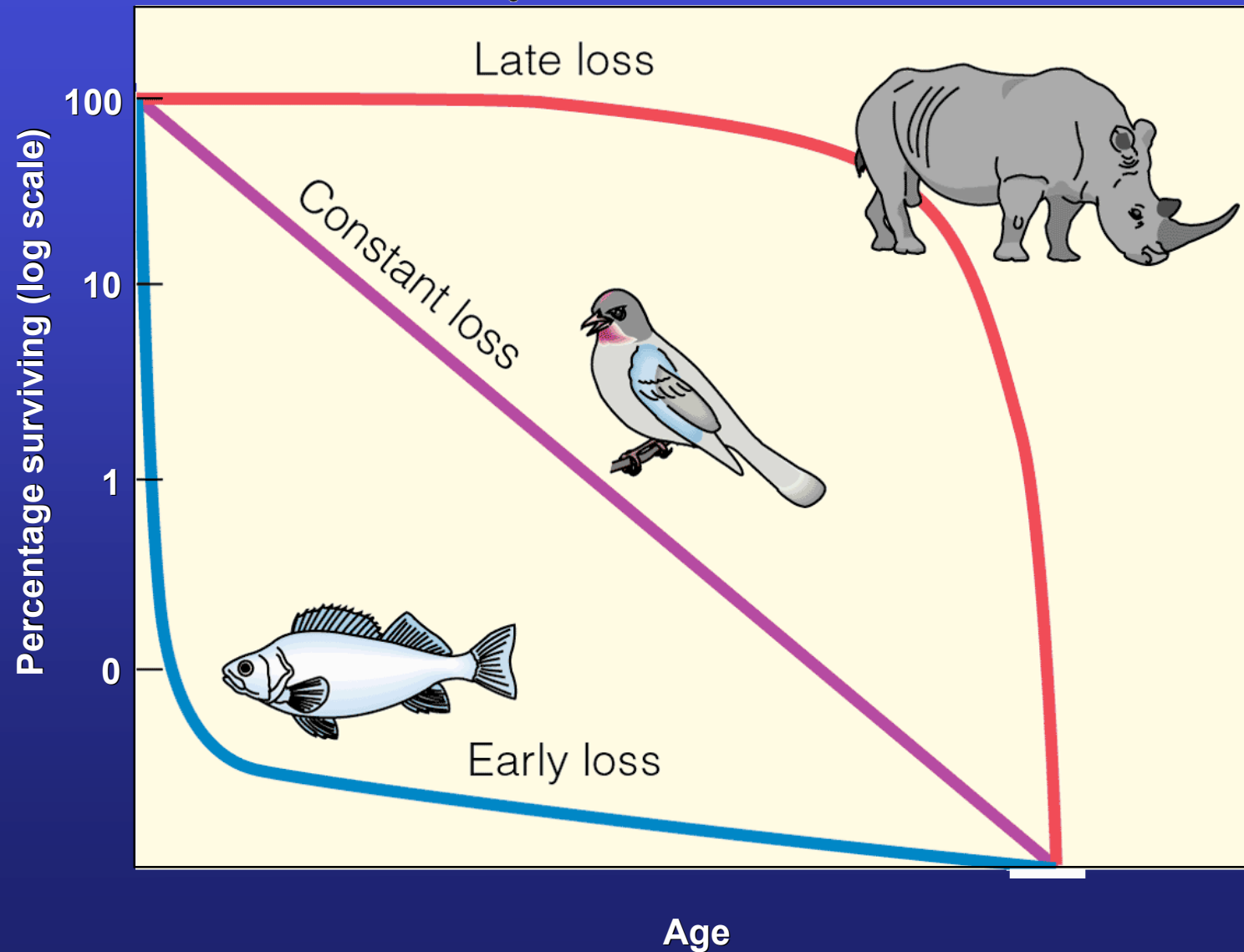


Fig. 9.11, p. 206

Conservation Biology: Sustaining Wildlife Populations

- **Investigate human impacts on biodiversity**
- **Ideas for maintaining biodiversity**
- **Endangered species management**
- **Wildlife reserves and ecological restoration**
- **Ecological economics**
- **Environmental ethics**
- **Wildlife management**

Human Impacts on Ecosystems

- **Habitat degradation and fragmentation**
- **Ecosystem simplification**
- **Genetic resistance**
- **Predator elimination**
- **Introduction of non-native species**
- **Overharvesting renewable resources**
- **Interference with ecological systems**

Learning from Nature

➤ **Interdependence**

➤ **Diversity**

➤ **Resilience**

See Connections p. 208

➤ **Adaptability**

➤ **Unpredictability**

➤ **Limits**